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(54) PRODUCTION OF CORDIERITE CERAMIC MATERIAL

## (57)Abstract:

PURPOSE: To provide a method for producing a cordierite ceramic material by which the cordierite ceramic material having low thermal expansibility can be produced at a low cost by using a regenerated raw material.

CONSTITUTION: An unbaked regenerated raw material recovered in a process for producing a cordierite ceramic material is pulverized to prepare a pulverized material, from which the pulverized material having <1mm diameter is removed. Water is then added to knead the remaining pulverized material. Thereby, a regenerated clay is prepared, formed and baked to afford a cordierite ceramic material. For example, the pulverized material having substantially 1mm diameter remains after removing the pulverized material having <1mm diameter. The removal of the pulverized material having <1mm diameter is carried out by using, e.g. a sieve having 1mm opening size.

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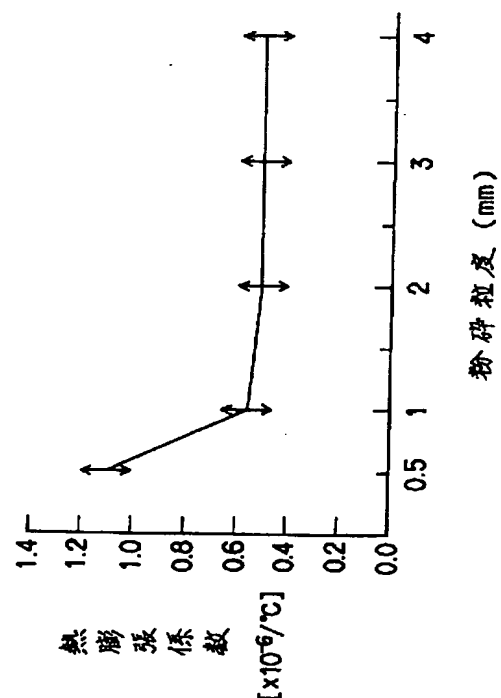
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(54) 【発明の名称】 コーディエライトセラミック体の製造方法

(57) 【要約】

【課題】 再生原料を用いて、低熱膨張のコーディエライトセラミック体を安価に製造することができる、コーディエライトセラミック体の製造方法を提供すること。

【解決手段】 コーディエライトセラミック体の製造工程において回収される、未焼成の再生原料を粉砕して粉砕物を作成する。該粉砕物より、直径1mm未満の粉砕物を除去する。次に、残った粉砕物に水分を加え、且つ、混練することによって、再生粘土を作成する。再生粘土を成形し、焼成してコーディエライトセラミック体を得る。例えば、直径1mm未満の粉砕物の除去の後には、実質的に直径1mm以上の粉砕物が残る。この除去は、例えば、目開き1mm以上の篩により行う。



## 【特許請求の範囲】

【請求項1】 コーディエライトセラミック体の製造工程において回収される、未焼成の再生原料よりコーディエライトセラミック体を製造する方法であって、前記再生原料を粉砕して粉砕物を作成し、該粉砕物より、直径1mm未満の粉砕物を除去し、残った粉砕物に水分を加え、かつ、混練することによって、再生粘土を作成し、該再生粘土を成形し、焼成することを特徴とするコーディエライトセラミック体の製造方法。

【請求項2】 請求項1において、直径1mm未満の粉砕物の除去に当たっては、分級することによって、実質的に直径1mm以上の粉砕物を残すことを特徴とするコーディエライトセラミック体の製造方法。

【請求項3】 請求項1又は2において、前記直径1mm未満の粉砕物の除去の際には、直径200mmを越える粉砕物の除去をも行うことによって、実質的に直径が1mm以上かつ200mm以下の粉砕物を残すことを特徴とするコーディエライトセラミック体の製造方法。

【請求項4】 コーディエライトセラミック体の製造工程において回収される、未焼成の再生原料よりコーディエライトセラミック体を製造する方法であって、前記再生原料を粉砕して粉砕物を作成し、100kgの粉砕物を篩の目開きが1mmであり、振動数が40Hzであって、かつ処理能力が30kg/分の条件で分級した時と同程度以上の分級によって、前記粉砕物を分級し、分級された前記粉砕物のうち直径の大なる粉砕物に水分を加え、混練することによって、再生粘土を作成し、該再生粘土を成形し、焼成することを特徴とするコーディエライトセラミック体の製造方法。

【請求項5】 請求項4において、前記直径1mm未満の粉砕物の除去に当たっては、分級することによって、実質的に直径1mm以上の粉砕物を残すことを特徴とするコーディエライトセラミック体の製造方法。

【請求項6】 請求項4又は5において、前記直径1mm未満の粉砕物の除去の際には、直径200mmを越える粉砕物の除去をも行うことによって、実質的に直径が1mm以上かつ200mm以下の粉砕物を残すことを特徴とするコーディエライトセラミック体の製造方法。

## 【発明の詳細な説明】

## 【0001】

【技術分野】本発明は、コーディエライトセラミック体の製造工程において回収される未焼成の再生原料を用いて、コーディエライトセラミック体を製造する、コーディエライトセラミック体の製造方法に関する。

## 【0002】

【従来技術】コーディエライトセラミック体は、耐熱性を有し、また、広い温度範囲において、低い熱膨張係数を有することが知られている。このため、コーディエライトセラミック体は、各種排気ガス中のHC、CO、NO<sub>x</sub>等を浄化するために用いるハニカム状触媒担体とし

て、特に注目されている。

【0003】コーディエライトセラミック体を製造するに当たっては、タルク、カオリン、アルミナ等の出発原料を成形し、焼成する。コーディエライトセラミック体を低熱膨張性とするためには、上記製造過程において、出発原料の粒子の直径、原料組成等を最適化する必要がある。また、コーディエライトセラミック体を経済的に製造するには、成形工程から焼成工程に移行する際に除外される未焼成の成形体又はその破片等の廃棄物を、再生原料として再生使用することが望ましい。

## 【0004】

【解決しようとする課題】しかしながら、上記再生原料を用いて製造されたコーディエライトセラミック体は、元来の出発原料を用いて製造されたコーディエライトセラミック体に比べて、その熱膨張係数が大きくなり、耐熱性が劣化するという問題がある。特に、低熱膨張性が要求される自動車排気ガス浄化用の触媒担体としては、使用できないものであった。

【0005】そこで、かかる問題の対処方法として、従来、コーディエライトセラミック体の加圧成形面におけるプロトエンスタタイト面とコーディエライト面とのX線回折ピーク強度が一定値となるように、再生原料を調製する方法が提案されている（特公平3-72032号公報）。しかし、この方法においては、再生原料を得る方法として具体的な方法が開示されておらず、当業者が好ましい再生原料を簡易に得ることは困難であった。

【0006】本発明はかかる従来の問題点に鑑み、再生原料を用いて、低熱膨張のコーディエライトセラミック体を安価に製造することができる、コーディエライトセラミック体の製造方法を提供しようとするものである。

## 【0007】

【課題の解決手段】本発明は、コーディエライトセラミック体の製造工程において回収される、未焼成の再生原料よりコーディエライトセラミック体を製造する方法であって、前記再生原料を粉砕して粉砕物を作成し、該粉砕物より、直径1mm未満の粉砕物を除去し、残った粉砕物に水分を加え、かつ、混練することによって、再生粘土を作成し、該再生粘土を成形し、焼成することを特徴とするコーディエライトセラミック体の製造方法にある。

【0008】本発明において最も注目すべきことは、上記再生原料を粉砕した後、直径1mm未満の粉砕物を除去することである。

【0009】次に、本発明の作用について説明する。本発明のコーディエライトセラミック体の製造方法においては、再生原料を粉砕し、直径1mm未満の粉砕物を除去している。そのため、残った粉砕物の直径は、実質的に1mm以上となる。このため、粉砕物中の粒子の破損が少なく、扁平な形状を有している。そのため、成形時の圧力により、粉砕物中の再生原料の結晶軸を配向させ

ることができる。このように、結晶軸が配向した再生原料の成形体を焼成すると、その焼結体も結晶軸を配向した状態となる。その結果、結晶軸方向の熱膨張係数が異なる異方性のコーディエライトセラミック体を得ることができる。

【0010】以上のごとく、本発明の製造方法によれば、コーディエライトセラミック体の製造工程において回収されるスクラップを、再生原料として有効に利用することができる。このため、原料歩留りの著しい向上が達成され、コスト低減を図ることができ、安価なコーディエライトセラミック体を製造することができる。上記製造方法により得られたコーディエライトセラミック体は、例えば、自動車排気ガス浄化装置におけるハニカム担体として有効に使用することができる。また、産業用熱交換機等にも用いることができる。

【0011】次に、本発明を詳しく説明する。上記再生原料は、コーディエライトセラミック体を製造するための成形体に利用されなかった、未焼成の成形体又はその破片である。この再生原料は、タルク、カオリン、アルミナ等の、コーディエライトセラミック体の一般的な組成からなる。この再生原料には、新たなコーディエライト原料を添加、混合することもできる。

【0012】上記再生原料は粉碎して用いる。再生原料の中には、一般のコーディエライトセラミック体を作成する際に用いるバインダが混在している。バインダはコーディエライトセラミック体の組成粒子の結合材であるため、再生原料は比較的大きな塊となっている。このため、この塊の再生原料を粉碎し、適切な大きさに分解する。

【0013】なお、粉碎を容易にするため、上記再生原料は、予め乾燥しておくことが好ましい。粉碎の程度は、粉碎物の中に直径1mm以上のものが十分に残る程度とする。粉碎方法としては、ジョークラッシャ、ローラミル、ピンミルがある。

【0014】次に、この粉碎物の内、直径1mm未満のものを除去する。粉碎物の中に、直径1mm未満のものが残ると、低熱膨張又は低熱膨張係数を有するコーディエライトセラミック体を得ることが困難となる。

【0015】分級により残す粉碎物は、実質的に直径1mm以上のものであればよい。例えば、実質的に直径2mm以上の粉碎物を残し、これを用いてコーディエライトセラミック体を製造することもできる。直径1mm未満の粉碎物の除去の際には、直径200mmを超える粉碎物をも除去することによって、実質的に直径1mm以上で且つ直径200mm以下の粉碎物を残すことが好ましい。直径200mmを超える粉碎物が残ると、水分を加えて混練した場合にも、再生原料を得ることができないおそれがある。

【0016】ここで、上記の実質的に直径1mm以上の粉碎物とは、直径1mm以上の粉碎物に、直径1mm未

満の粉碎物が付着するなどして、直径1mm未満の粉碎物を完全に分級することができないため、残った直径1mm以上の粉碎物の中にわずかに直径1mm未満の粉碎物が混入していることをいう。直径1mm未満の粉碎物が混入していることは、コーディエライトセラミック体の結晶軸の配向性を低下させることとなるため、可能な限り混入を防止することが好ましい。かかる観点より、実質的に残った直径1mm以上の粉碎物の中には、直径1mm未満の粉碎物が0~3重量%以下混入していることが好ましい。3重量%を超える場合には、コーディエライトセラミック体の結晶軸の配向性が低下するおそれがある。上記粉碎物の直径は、目開き1mm以上の篩残差測定法により測定される。

【0017】上記粉碎物の除去は、例えば、粉碎物を分級することによって、実質的に直径1mm以上の粉碎物を残し、直径1mm未満の粉碎物を除去する。上記の粉碎物の分級は、例えば、目開きが1mm以下の篩、直径1mm未満の粉碎物を除去できる程度の強さの気流により行うことができる。

【0018】上記コーディエライトセラミック体の製造方法としては、例えば、コーディエライトセラミック体の製造工程において回収される、未焼成の再生原料よりコーディエライトセラミック体を製造する方法であって、前記再生原料を粉碎して粉碎物を作成し、100kgの粉碎物を篩の目開きが1mmであり、振動数が40Hzであって、かつ処理能力が30kg/分の条件で分級した時と同程度以上の分級によって、前記粉碎物を分級し、分級された前記粉碎物のうち直径の大なる粉碎物に水分を加え、混練することによって、再生粘土を作成し、該再生粘土を成形し、焼成することの特徴とするコーディエライトセラミック体の製造方法である。

【0019】上記の製造方法において、粉碎物の分級は、100kgの粉碎物を篩の目開きが1mmであり、振動数が40Hzであって、かつ処理能力が30kg/分の条件で行うか、又はこの条件と同程度以上の条件で行う。これにより、低熱膨張のコーディエライトセラミック体を安価に、かつ容易に製造することができる。具体的には、分級する粉碎物の重量が100kg以上であり、篩の目開きが1mm以上であり、振動数が40Hz以上であり、又は、処理能力が30kg/分以上である条件で行う。また、上記の篩を用いる方法以外にも、上記と同程度以上の分級性能を有する方法であれば、支障なく分級をすることができる。

【0020】直径1mm未満の粉碎物を除去するに当たっては、分級により、実質的に直径1mm以上の粉碎物が残る。直径1mm未満の粉碎物の除去の際には、上記と同様の理由により、直径200mmを超える粉碎物をも除去して、実質的に1mm以上かつ200mm以下の粉碎物を残すことが好ましい。

【0021】直径1mm以上の粉碎物には、水分を加

え、混練し、所望の形状に成形して用いる。混練の際には、メチルセルローズ等のバインダを添加することができる。この成形体は、一般のコーディエライトセラミック体の製造過程における焼成温度と同程度の温度で、焼成する。具体的には、1350～1450℃で焼成することが好ましい。1350℃未満の場合には、良好なコーディエライト結晶が得られないおそれがある。一方、1450℃を越える場合には、成形体が溶解するおそれがある。上記焼成前には、成形体を乾燥することが好ましい。これにより、焼成時に、急激な水分蒸発によってコーディエライトセラミック体にクラックが発生することを防止することができる。

【0022】

【発明の実施の形態】

実施形態例1

本発明の実施形態例に係るコーディエライトセラミック体の製造方法について説明する。本例は、コーディエライトセラミック体の製造工程において回収される未焼成の再生原料を用いて、コーディエライトセラミック体を製造する方法である。

【0023】上記再生原料は、表1に示す組成であって、未焼成の乾燥物である。この乾燥物100kgを、ロールクラッシャーに投入し、回転数50RPM、処理能力20kg/分の条件で粉砕した。次に、この粉砕物\*

表1 再生原料の組成

成 分		(重量%)
セラミック原料	カオリン	35
	タルク	27
	アルミナ	4
	水酸化アルミニウム	12
有機バインダ	メチルセルローズ	3
水 分		19

【0027】実施形態例2

本例においては、図1に示すごとく、分級工程により得られた粉砕物の粉砕粒度とコーディエライトセラミック体の熱膨張係数との関係を測定した。測定に際し、粉砕物の分級は、篩の目開きの大きさを0.5～4mmの範囲で変化させた。各分級毎の粉砕物を用いて、実施例1

\*を篩目開き1mmで、振動数40Hz、処理能力30kg/分の条件で分級して、直径1mm未満の粉砕物を26kg除去した。これにより、直径が1mm以上でかつ3mm未満の粉砕物を62kg、また直径1mm以上の粉砕物を12kg残した。

【0024】次に、上記直径1mm以上の粉砕物に水分を加え、混練して、再生粘土を作成した。この再生粘土を、金型を用いた押出成形法により、成形した。この成形体は、リブ厚さが0.18mmであり、1平方センチ当たりのセル数が約62個のハニカム体である。次に、この成形体を高周波乾燥機を用いて乾燥した。乾燥後、1400℃、5時間焼成して、ハニカム状のコーディエライトセラミック体を得た。

【0025】得られたコーディエライトセラミック体の40～800℃における平均熱膨張係数は、 $0.6 \times 10^{-6}/^{\circ}\text{C}$ であった。このコーディエライトセラミック体に排気ガス浄化用触媒を担持し、これを自動車の排気ガス浄化装置に取り付けた。そして、通常の浄化装置と同様にテストした。その結果、本例の再生原料を用いて製造したコーディエライトセラミック体は、一般のコーディエライトセラミック体と同様に、優れた耐久性、耐熱性を示した。

【0026】

【表1】

と同様にコーディエライトセラミック体を製造した。各コーディエライトセラミック体の40～800℃における平均熱膨張係数を測定した。その結果を図1に示した。

【0028】同図より、直径が1mm以上の粉砕物を用いた場合には、低い熱膨張係数が得られた。一方、直径

が1mm未満の粉碎物を用いた場合には、直径が小さくなるほど急激に熱膨張係数が上昇した。このことから、分級により直径1mm未満の粉碎物を除去し、直径1mm以上の粉碎物だけを用いることにより、一般のコーディエライトセラミック体と同様に、低熱膨張係数のコーディエライトセラミック体を製造することができることがわかる。

【0029】

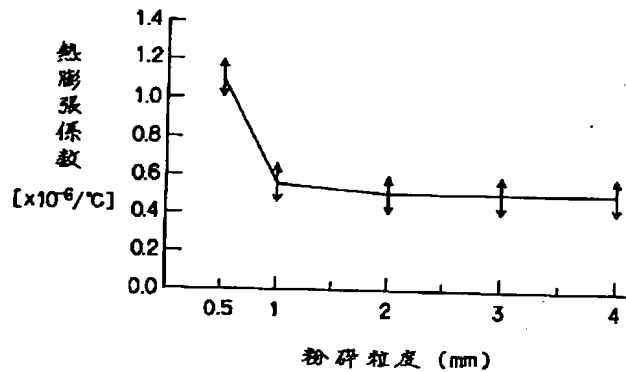
\*

\*【発明の効果】本発明によれば、再生原料を用いて、低熱膨張のコーディエライトセラミック体を安価に製造することができる。コーディエライトセラミック体の製造方法を提供することができる。

【図面の簡単な説明】

【図1】実施形態例2の、粉碎物の粉碎粒度に対するコーディエライトセラミック体の熱膨張係数の特性線図。

【図1】



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CLAIMS

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[Claim(s)]

[Claim 1] From the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, are the approach of manufacturing a cordierite ceramic object and said playback raw material is ground. The manufacture approach of the cordierite ceramic object which creates playback clay, fabricates this playback clay, and is characterized by calcinating by creating a grinding object, removing a grinding object with a diameter of less than 1mm from this grinding object, and applying and kneading moisture in the remaining grinding object.

[Claim 2] The manufacture approach of the cordierite ceramic object characterized by leaving a grinding object with a diameter of 1mm or more substantially by classifying in removal of a grinding object with a diameter of less than 1mm in claim 1.

[Claim 3] The manufacture approach of the cordierite ceramic object characterized by a diameter leaving a grinding object (1mm or more and 200mm or less) substantially by performing removal of the grinding object exceeding the diameter of 200mm in claim 1 or 2 in the case of removal of a grinding object with a diameter [ said ] of less than 1mm.

[Claim 4] From the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, are the approach of manufacturing a cordierite ceramic object and said playback raw material is ground. By the classification the time of having created the grinding object, and an opening being 1mm, and vibration frequency being 40Hz, and a throughput classifying a 100kg grinding object the condition for 30kg/, and more than comparable the inside of said grinding object which classified said grinding object and was classified -- a diameter -- size -- the manufacture approach of the cordierite ceramic object which creates playback clay, fabricates this playback clay, and is characterized by calcinating by applying and kneading moisture in a grinding object.

[Claim 5] The manufacture approach of the cordierite ceramic object characterized by leaving a grinding object with a diameter of 1mm or more substantially by classifying in removal of a grinding object with a diameter [ said ] of less than 1mm in claim 4.

[Claim 6] The manufacture approach of the cordierite ceramic object characterized by a diameter leaving a grinding object (1mm or more and 200mm or less) substantially by performing removal of the grinding object exceeding the diameter of 200mm in claim 4 or 5 in the case of removal of a grinding object with a diameter [ said ] of less than 1mm.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of a cordierite ceramic object of manufacturing a cordierite ceramic object, using the non-calcinated playback raw material collected in the production process of a cordierite ceramic object.

[0002]

[Description of the Prior Art] A cordierite ceramic object having thermal resistance, and having a low coefficient of thermal expansion in a large temperature requirement is known. for this reason, a cordierite ceramic object -- HC, CO, and NOX in [ various ] exhaust gas etc. -- in order to purify, it is especially observed as honeycomb-like catalyst support to be used.

[0003] In manufacturing a cordierite ceramic object, start raw materials, such as talc, a kaolin, and an alumina, are fabricated and calcinated. In order to make a cordierite ceramic object into low-feeve expansibility, in the above-mentioned manufacture process, it is necessary to optimize the diameter of the particle of a start raw material, a raw material presentation, etc. Moreover, in order to manufacture a cordierite ceramic object economically, it is desirable to carry out playback use of the trash, such as a non-calcinated Plastic solid excepted in case it shifts to a baking process from a forming cycle, or its fragment, as a playback raw material.

[0004]

[Problem(s) to be Solved] However, compared with the cordierite ceramic object manufactured using the original start raw material, the coefficient of thermal expansion becomes large, and the cordierite ceramic object manufactured using the above-mentioned playback raw material has the problem that thermal resistance deteriorates. As catalyst support for motor exhaust purification as which low-feeve expansibility is required especially, it was what cannot be used.

[0005] Then, the method of preparing a playback raw material is proposed so that the X diffraction peak intensity of the PUROTO enstatite side and cordierite side in the pressing side of a cordierite ceramic object may serve as constant value conventionally as a solution of this problem (Japanese Patent Publication No. 3-No. 72032 official report). However, in this approach, it was difficult not to indicate an approach concrete as an approach of obtaining a playback raw material, but for this contractor to get a desirable playback raw material simply.

[0006] This invention tends to offer the manufacture approach of a cordierite ceramic object that the cordierite ceramic object of low-feeve expansion can be manufactured cheaply, in view of this conventional trouble using a playback raw material.

[0007]

[Means for Solving the Problem] From the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, this invention is the approach of manufacturing a cordierite ceramic object, and grinds said playback raw material. By creating a grinding object, removing a grinding object with a diameter of less than 1mm from this grinding object, and applying and kneading moisture in the remaining grinding object, playback clay is created and it is in the



manufacture approach of the cordierite ceramic object characterized by fabricating and calcinating this playback clay.

[0008] What should be most observed in this invention is removing a grinding object with a diameter of less than 1mm, after grinding the above-mentioned playback raw material.

[0009] Next, an operation of this invention is explained. In the manufacture approach of the cordierite ceramic object of this invention, the playback raw material was ground and the grinding object with a diameter of less than 1mm is removed. Therefore, the diameter of the remaining grinding object is substantially set to 1mm or more. For this reason, there is little breakage of the particle in a grinding object, and it has the flat configuration. Therefore, orientation of the crystallographic axis of the playback raw material in a grinding object can be carried out with the pressure at the time of shaping. Thus, if the Plastic solid of the playback raw material in which the crystallographic axis carried out orientation is calcinated, the sintered compact will also be in the condition of having carried out orientation of the crystallographic axis. Consequently, the cordierite ceramic object of an anisotropy with which the coefficients of thermal expansion of crystal orientation differ can be acquired.

[0010] According to the manufacture approach of this invention, like the above, the scrap collected in the production process of a cordierite ceramic object can be effectively used as a playback raw material. For this reason, the remarkable improvement in the raw material yield can be attained, cost reduction can be planned, and a cheap cordierite ceramic object can be manufactured. The cordierite ceramic object acquired by the above-mentioned manufacture approach can be effectively used as honeycomb support for example, in a motor exhaust purge. Moreover, it can use for an industrial heat exchange machine etc.

[0011] Next, this invention is explained in detail. The above-mentioned playback raw material is the non-calcinated Plastic solid which was not used for the Plastic solid for manufacturing a cordierite ceramic object, or its fragment. This playback raw material consists of a general presentation of a cordierite ceramic object of talc, a kaolin, an alumina, etc. In this playback raw material, a new cordierite raw material can also be added and it can also mix.

[0012] The above-mentioned playback raw material is ground and used. The binder used into a playback raw material in case a common cordierite ceramic object is created is intermingled. Since a binder is the binding material of the presentation particle of a cordierite ceramic object, the playback raw material serves as a comparatively big lump. For this reason, this lump's playback raw material is ground and it decomposes into suitable magnitude.

[0013] In addition, as for the above-mentioned playback raw material, drying beforehand is desirable in order to make grinding easy. Let extent of grinding be extent with which a thing with a diameter of 1mm or more fully remains into a grinding object. As the grinding approach, there are a jaw crusher, a roller mill, and a pin mill.

[0014] Next, a thing with a diameter of less than 1mm is removed among this grinding object. If a thing with a diameter of less than 1mm remains into a grinding object, it will become difficult to acquire the cordierite ceramic object which has low-fever expansion or a low-fever expansion coefficient.

[0015] The grinding object which it leaves by the classification should just be a thing with a diameter of 1mm or more substantially. For example, it can leave a grinding object with a diameter of 2mm or more substantially, and a cordierite ceramic object can also be manufactured using this. It is desirable by removing the grinding object exceeding the diameter of 200mm in the case of removal of a grinding object with a diameter of less than 1mm to be 1mm or more in diameter substantially, and to leave a grinding object with a diameter of 200mm or less. Also when the grinding object exceeding the diameter of 200mm remained and moisture is applied and kneaded, there is a possibility that a playback raw material cannot be obtained.

[0016] Here, substantially [ the above ], since a grinding object with a diameter of less than 1mm adheres to a grinding object with a diameter of 1mm or more and a grinding object with a diameter of 1mm or more cannot classify completely a grinding object with a diameter of less than 1mm, it means that the grinding object with a diameter of less than 1mm is mixing slightly into a grinding object with a diameter of 1mm or more which remained. In order to make the stacking tendency of the

crystallographic axis of a cordierite ceramic object fall, as for the grinding object with a diameter of less than 1mm mixing, it is desirable to prevent mixing as much as possible. It is more desirable than this viewpoint that the grinding object with a diameter of less than 1mm is mixing 0 to 3 or less % of the weight into a grinding object with a diameter of 1mm or more which remained substantially. In exceeding 3 % of the weight, there is a possibility that the stacking tendency of the crystallographic axis of a cordierite ceramic object may fall. The diameter of the above-mentioned grinding object is measured by the siftings difference measuring method of 1mm or more of openings.

[0017] By classifying for example, a grinding object, removal of the above-mentioned grinding object leaves a grinding object with a diameter of 1mm or more substantially, and removes a grinding object with a diameter of less than 1mm. An opening can perform the classification of the above-mentioned grinding object according to the air current of the strength of extent which can remove a screen 1mm [ or less ] and a grinding object with a diameter of less than 1mm.

[0018] As the manufacture approach of the above-mentioned cordierite ceramic object For example, from the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, are the approach of manufacturing a cordierite ceramic object and said playback raw material is ground. By the classification the time of having created the grinding object, and an opening being 1mm, and vibration frequency being 40Hz, and a throughput classifying a 100kg grinding object the condition for 30kg/, and more than comparable It is the manufacture approach of the cordierite ceramic object which creates playback clay, fabricates this playback clay, and is characterized by calcinating by classifying said grinding object, and applying and kneading moisture in the grinding object which is a diameter among said classified grinding objects and which becomes size.

[0019] In the above-mentioned manufacture approach, an opening is 1mm, and vibration frequency is 40Hz, a throughput performs a 100kg grinding object the condition for 30kg/, or the classification of a grinding object performs it the condition this condition and more than comparable. Thereby, the cordierite ceramic object of low-fever expansion can be manufactured cheaply and easily. The weight of the grinding object which classifies is 100kg or more, an opening is 1mm or more, and vibration frequency is 40Hz or more, or, specifically, a throughput carries out on 30kg conditions it is [ conditions ] above by /. Moreover, if it is the approach of having the above and the performance of classification more than comparable besides the approach using the above-mentioned screen, a classification can be carried out convenient.

[0020] In removing a grinding object with a diameter of less than 1mm, a grinding object with a diameter of 1mm or more remains substantially by the classification. It is desirable to also remove the grinding object exceeding the diameter of 200mm in the case of removal of a grinding object with a diameter of less than 1mm, and to leave a grinding object (1mm or more and 200mm or less) substantially for the same reason as the above, at it.

[0021] Moisture is applied and kneaded in a grinding object with a diameter of 1mm or more, and it fabricates and uses for a desired configuration. Binders, such as methyl cellulose, can be added in the case of kneading. This Plastic solid is calcinated at temperature comparable as the burning temperature in the manufacture process of a common cordierite ceramic object. Specifically, it is desirable to calcinate at 1350-1450 degrees C. In the case of less than 1350 degrees C, there is a possibility that a good cordierite crystal may not be obtained. On the other hand, in exceeding 1450 degrees C, there is a possibility that a Plastic solid may dissolve. It is desirable to dry a Plastic solid before the above-mentioned baking. It can prevent that a crack occurs on a cordierite ceramic object by rapid moisture evaporation by this at the time of baking.

[0022]

[Embodiment of the Invention]

The manufacture approach of the cordierite ceramic object concerning the example of an operation gestalt of example of operation gestalt 1 this invention is explained. This example is the approach of manufacturing a cordierite ceramic object using the non-calcinated playback raw material collected in the production process of a cordierite ceramic object.

[0023] The above-mentioned playback raw material is a presentation shown in Table 1, and is a non-

calcinated dry matter. 100kg of this dry matter was fed into the roll crusher, and it was ground the condition for rotational frequency 50RPM and 20kg/of throughputs. Next, this grinding object was classified the condition for vibration frequency [ of 40Hz ], and 30kg/of throughputs by 1mm of mesh apertures, and 26kg of grinding objects with a diameter of less than 1mm was removed. Thereby, a diameter is 1mm or more, and it left 62kg and 12kg of grinding objects with a diameter of 1mm or more for the less than 3mm grinding object.

[0024] Next, moisture was applied and kneaded in the grinding object with an above-mentioned diameter of 1mm or more, and playback clay was created. This playback clay was fabricated by the extrusion method using metal mold. Rib thickness is 0.18mm and this Plastic solid is a honeycomb object whose number of cels per 1 square centimeter is about 62 pieces. Next, this Plastic solid was dried using the high frequency dryer. After desiccation, it calcinated for 5 hours and 1400 degrees C of cordierite ceramic honeycomb-like objects were acquired.

[0025] The average coefficient of thermal expansion in 40-800 degrees C of the acquired cordierite ceramic object was  $0.6 \times 10^{-6}$ /degree C. The catalyst for exhaust gas purification was supported on this cordierite ceramic object, and this was attached in the exhaust gas purge of an automobile. And it tested like the usual purge. Consequently, the cordierite ceramic object manufactured using the playback raw material of this example showed the outstanding endurance and thermal resistance like the common cordierite ceramic object.

[0026]

[Table 1]

表1 再生原料の組成

成 分		(重量%)
セラミック原料	カオリン	35
	タルク	27
	アルミナ	4
	水酸化アルミニウム	12
有機バインダ	メチルセルロース	3
水 分		19

[0027] In the example of two examples of an operation gestalt, as shown in drawing 1, the relation of the grinding grain size of a grinding object and the coefficient of thermal expansion of a cordierite ceramic object which were obtained according to the classification process was measured. On the occasion of measurement, the classification of a grinding object changed the magnitude of an opening in 0.5-4mm. The cordierite ceramic object was manufactured like the example 1 using the grinding object for every classification. The average coefficient of thermal expansion in 40-800 degrees C of each cordierite ceramic object was measured. The result was shown in drawing 1.

[0028] From this drawing, when a diameter used a grinding object 1mm or more, the low coefficient of thermal expansion was obtained. On the other hand, when a diameter used a less than 1mm grinding

object, the coefficient of thermal expansion rose so rapidly that a diameter becomes small. By a classification's removing a grinding object with a diameter of less than 1mm, and using only a grinding object with a diameter of 1mm or more from this, shows that the cordierite ceramic object of a low-fever expansion coefficient can be manufactured like a common cordierite ceramic object.

[0029]

[Effect of the Invention] According to this invention, the manufacture approach of a cordierite ceramic object that the cordierite ceramic object of low-fever expansion can be manufactured cheaply can be offered using a playback raw material.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the manufacture approach of a cordierite ceramic object of manufacturing a cordierite ceramic object, using the non-calcinated playback raw material collected in the production process of a cordierite ceramic object.

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PRIOR ART

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[Description of the Prior Art] A cordierite ceramic object having thermal resistance, and having a low coefficient of thermal expansion in a large temperature requirement is known. for this reason, a cordierite ceramic object -- HC, CO, and NOX in [ various ] exhaust gas etc. -- in order to purify, it is especially observed as honeycomb-like catalyst support to be used.

[0003] In manufacturing a cordierite ceramic object, start raw materials, such as talc, a kaolin, and an alumina, are fabricated and calcinated. In order to make a cordierite ceramic object into low-thermal expansibility, in the above-mentioned manufacture process, it is necessary to optimize the diameter of the particle of a start raw material, a raw material presentation, etc. Moreover, in order to manufacture a cordierite ceramic object economically, it is desirable to carry out playback use of the trash, such as a non-calcinated Plastic solid excepted in case it shifts to a baking process from a forming cycle, or its fragment, as a playback raw material.

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention, the manufacture approach of a cordierite ceramic object that the cordierite ceramic object of low-thermal expansion can be manufactured cheaply can be offered using a playback raw material.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved] However, compared with the cordierite ceramic object manufactured using the original start raw material, the coefficient of thermal expansion becomes large, and the cordierite ceramic object manufactured using the above-mentioned playback raw material has the problem that thermal resistance deteriorates. As catalyst support for motor exhaust purification as which low-temperature expansibility is required especially, it was what cannot be used.

[0005] Then, the method of preparing a playback raw material is proposed so that the X diffraction peak intensity of the PUROTO enstatite side and cordierite side in the pressing side of a cordierite ceramic object may serve as constant value conventionally as a solution of this problem (Japanese Patent Publication No. 3-No. 72032 official report). However, in this approach, it was difficult not to indicate an approach concrete as an approach of obtaining a playback raw material, but for this contractor to get a desirable playback raw material simply.

[0006] This invention tends to offer the manufacture approach of a cordierite ceramic object that the cordierite ceramic object of low-temperature expansion can be manufactured cheaply, in view of this conventional trouble using a playback raw material.

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MEANS

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[Means for Solving the Problem] From the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, this invention is the approach of manufacturing a cordierite ceramic object, and grinds said playback raw material. By creating a grinding object, removing a grinding object with a diameter of less than 1mm from this grinding object, and applying and kneading moisture in the remaining grinding object, playback clay is created and it is in the manufacture approach of the cordierite ceramic object characterized by fabricating and calcinating this playback clay.

[0008] What should be most observed in this invention is removing a grinding object with a diameter of less than 1mm, after grinding the above-mentioned playback raw material.

[0009] Next, an operation of this invention is explained. In the manufacture approach of the cordierite ceramic object of this invention, the playback raw material was ground and the grinding object with a diameter of less than 1mm is removed. Therefore, the diameter of the remaining grinding object is substantially set to 1mm or more. For this reason, there is little breakage of the particle in a grinding object, and it has the flat configuration. Therefore, orientation of the crystallographic axis of the playback raw material in a grinding object can be carried out with the pressure at the time of shaping. Thus, if the Plastic solid of the playback raw material in which the crystallographic axis carried out orientation is calcinated, the sintered compact will also be in the condition of having carried out orientation of the crystallographic axis. Consequently, the cordierite ceramic object of an anisotropy with which the coefficients of thermal expansion of crystal orientation differ can be acquired.

[0010] According to the manufacture approach of this invention, like the above, the scrap collected in the production process of a cordierite ceramic object can be effectively used as a playback raw material. For this reason, the remarkable improvement in the raw material yield can be attained, cost reduction can be planned, and a cheap cordierite ceramic object can be manufactured. The cordierite ceramic object acquired by the above-mentioned manufacture approach can be effectively used as honeycomb support for example, in a motor exhaust purge. Moreover, it can use for an industrial heat exchange machine etc.

[0011] Next, this invention is explained in detail. The above-mentioned playback raw material is the non-calcinated Plastic solid which was not used for the Plastic solid for manufacturing a cordierite ceramic object, or its fragment. This playback raw material consists of a general presentation of a cordierite ceramic object of talc, a kaolin, an alumina, etc. In this playback raw material, a new cordierite raw material can also be added and it can also mix.

[0012] The above-mentioned playback raw material is ground and used. The binder used into a playback raw material in case a common cordierite ceramic object is created is intermingled. Since a binder is the binding material of the presentation particle of a cordierite ceramic object, the playback raw material serves as a comparatively big lump. For this reason, this lump's playback raw material is ground and it decomposes into suitable magnitude.

[0013] In addition, as for the above-mentioned playback raw material, drying beforehand is desirable in order to make grinding easy. Let extent of grinding be extent with which a thing with a diameter of 1mm

or more fully remains into a grinding object. As the grinding approach, there are a jaw crusher, a roller mill, and a pin mill.

[0014] Next, a thing with a diameter of less than 1mm is removed among this grinding object. If a thing with a diameter of less than 1mm remains into a grinding object, it will become difficult to acquire the cordierite ceramic object which has low-thermal expansion or a low-thermal expansion coefficient.

[0015] The grinding object which it leaves by the classification should just be a thing with a diameter of 1mm or more substantially. For example, it can leave a grinding object with a diameter of 2mm or more substantially, and a cordierite ceramic object can also be manufactured using this. It is desirable by removing the grinding object exceeding the diameter of 200mm in the case of removal of a grinding object with a diameter of less than 1mm to be 1mm or more in diameter substantially, and to leave a grinding object with a diameter of 200mm or less. Also when the grinding object exceeding the diameter of 200mm remained and moisture is applied and kneaded, there is a possibility that a playback raw material cannot be obtained.

[0016] Here, substantially [ the above ], since a grinding object with a diameter of less than 1mm adheres to a grinding object with a diameter of 1mm or more and a grinding object with a diameter of 1mm or more cannot classify completely a grinding object with a diameter of less than 1mm, it means that the grinding object with a diameter of less than 1mm is mixing slightly into a grinding object with a diameter of 1mm or more which remained. In order to make the stacking tendency of the crystallographic axis of a cordierite ceramic object fall, as for the grinding object with a diameter of less than 1mm mixing, it is desirable to prevent mixing as much as possible. It is more desirable than this viewpoint that the grinding object with a diameter of less than 1mm is mixing 0 to 3 or less % of the weight into a grinding object with a diameter of 1mm or more which remained substantially. In exceeding 3 % of the weight, there is a possibility that the stacking tendency of the crystallographic axis of a cordierite ceramic object may fall. The diameter of the above-mentioned grinding object is measured by the siftings difference measuring method of 1mm or more of openings.

[0017] By classifying for example, a grinding object, removal of the above-mentioned grinding object leaves a grinding object with a diameter of 1mm or more substantially, and removes a grinding object with a diameter of less than 1mm. An opening can perform the classification of the above-mentioned grinding object according to the air current of the strength of extent which can remove a screen 1mm [ or less ] and a grinding object with a diameter of less than 1mm.

[0018] As the manufacture approach of the above-mentioned cordierite ceramic object For example, from the non-calcinated playback raw material collected in the production process of a cordierite ceramic object, are the approach of manufacturing a cordierite ceramic object and said playback raw material is ground. By the classification the time of having created the grinding object, and an opening being 1mm, and vibration frequency being 40Hz, and a throughput classifying a 100kg grinding object the condition for 30kg/, and more than comparable It is the manufacture approach of the cordierite ceramic object which creates playback clay, fabricates this playback clay, and is characterized by calcinating by classifying said grinding object, and applying and kneading moisture in the grinding object which is a diameter among said classified grinding objects and which becomes size.

[0019] In the above-mentioned manufacture approach, an opening is 1mm, and vibration frequency is 40Hz, a throughput performs a 100kg grinding object the condition for 30kg/, or the classification of a grinding object performs it the condition this condition and more than comparable. Thereby, the cordierite ceramic object of low-thermal expansion can be manufactured cheaply and easily. The weight of the grinding object which classifies is 100kg or more, an opening is 1mm or more, and vibration frequency is 40Hz or more, or, specifically, a throughput carries out on 30kg conditions it is [ conditions ] above by /. Moreover, if it is the approach of having the above and the performance of classification more than comparable besides the approach using the above-mentioned screen, a classification can be carried out convenient.

[0020] In removing a grinding object with a diameter of less than 1mm, a grinding object with a diameter of 1mm or more remains substantially by the classification. It is desirable to also remove the grinding object exceeding the diameter of 200mm in the case of removal of a grinding object with a

diameter of less than 1mm, and to leave a grinding object (1mm or more and 200mm or less) substantially for the same reason as the above, at it.

[0021] Moisture is applied and kneaded in a grinding object with a diameter of 1mm or more, and it fabricates and uses for a desired configuration. Binders, such as methyl cellulose, can be added in the case of kneading. This Plastic solid is calcinated at temperature comparable as the burning temperature in the manufacture process of a common cordierite ceramic object. Specifically, it is desirable to calcinate at 1350-1450 degrees C. In the case of less than 1350 degrees C, there is a possibility that a good cordierite crystal may not be obtained. On the other hand, in exceeding 1450 degrees C, there is a possibility that a Plastic solid may dissolve. It is desirable to dry a Plastic solid before the above-mentioned baking. It can prevent that a crack occurs on a cordierite ceramic object by rapid moisture evaporation by this at the time of baking.

[0022]

[Embodiment of the Invention]

The manufacture approach of the cordierite ceramic object concerning the example of an operation gestalt of example of operation gestalt 1 this invention is explained. This example is the approach of manufacturing a cordierite ceramic object using the non-calcinated playback raw material collected in the production process of a cordierite ceramic object.

[0023] The above-mentioned playback raw material is a presentation shown in Table 1, and is a non-calcinated dry matter. 100kg of this dry matter was fed into the roll crusher, and it was ground the condition for rotational frequency 50RPM and 20kg/of throughputs. Next, this grinding object was classified the condition for vibration frequency [ of 40Hz ], and 30kg/of throughputs by 1mm of mesh apertures, and 26kg of grinding objects with a diameter of less than 1mm was removed. Thereby, a diameter is 1mm or more, and it left 62kg and 12kg of grinding objects with a diameter of 1mm or more for the less than 3mm grinding object.

[0024] Next, moisture was applied and kneaded in the grinding object with an above-mentioned diameter of 1mm or more, and playback clay was created. This playback clay was fabricated by the extrusion method using metal mold. Rib thickness is 0.18mm and this Plastic solid is a honeycomb object whose number of cels per 1 square centimeter is about 62 pieces. Next, this Plastic solid was dried using the high frequency dryer. After desiccation, it calcinated for 5 hours and 1400 degrees C of cordierite ceramic honeycomb-like objects were acquired.

[0025] The average coefficient of thermal expansion in 40-800 degrees C of the acquired cordierite ceramic object was  $0.6 \times 10^{-6}$ /degree C. The catalyst for exhaust gas purification was supported on this cordierite ceramic object, and this was attached in the exhaust gas purge of an automobile. And it tested like the usual purge. Consequently, the cordierite ceramic object manufactured using the playback raw material of this example showed the outstanding endurance and thermal resistance like the common cordierite ceramic object.

[0026]

[Table 1]

表1 再生原料の組成

成 分		(重量%)
セラミック原料	カオリン	35
	タルク	27
	アルミナ	4
	水酸化アルミニウム	12
有機バインダ	メチルセルロース	3
水 分		19

[0027] In the example of two examples of an operation gestalt, as shown in drawing 1, the relation of the grinding grain size of a grinding object and the coefficient of thermal expansion of a cordierite ceramic object which were obtained according to the classification process was measured. On the occasion of measurement, the classification of a grinding object changed the magnitude of an opening in 0.5-4mm. The cordierite ceramic object was manufactured like the example 1 using the grinding object for every classification. The average coefficient of thermal expansion in 40-800 degrees C of each cordierite ceramic object was measured. The result was shown in drawing 1.

[0028] From this drawing, when a diameter used a grinding object 1mm or more, the low coefficient of thermal expansion was obtained. On the other hand, when a diameter used a less than 1mm grinding object, the coefficient of thermal expansion rose so rapidly that a diameter becomes small. By a classification's removing a grinding object with a diameter of less than 1mm, and using only a grinding object with a diameter of 1mm or more from this, shows that the cordierite ceramic object of a low-thermal expansion coefficient can be manufactured like a common cordierite ceramic object.

[0029]

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[Translation done.]

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DESCRIPTION OF DRAWINGS

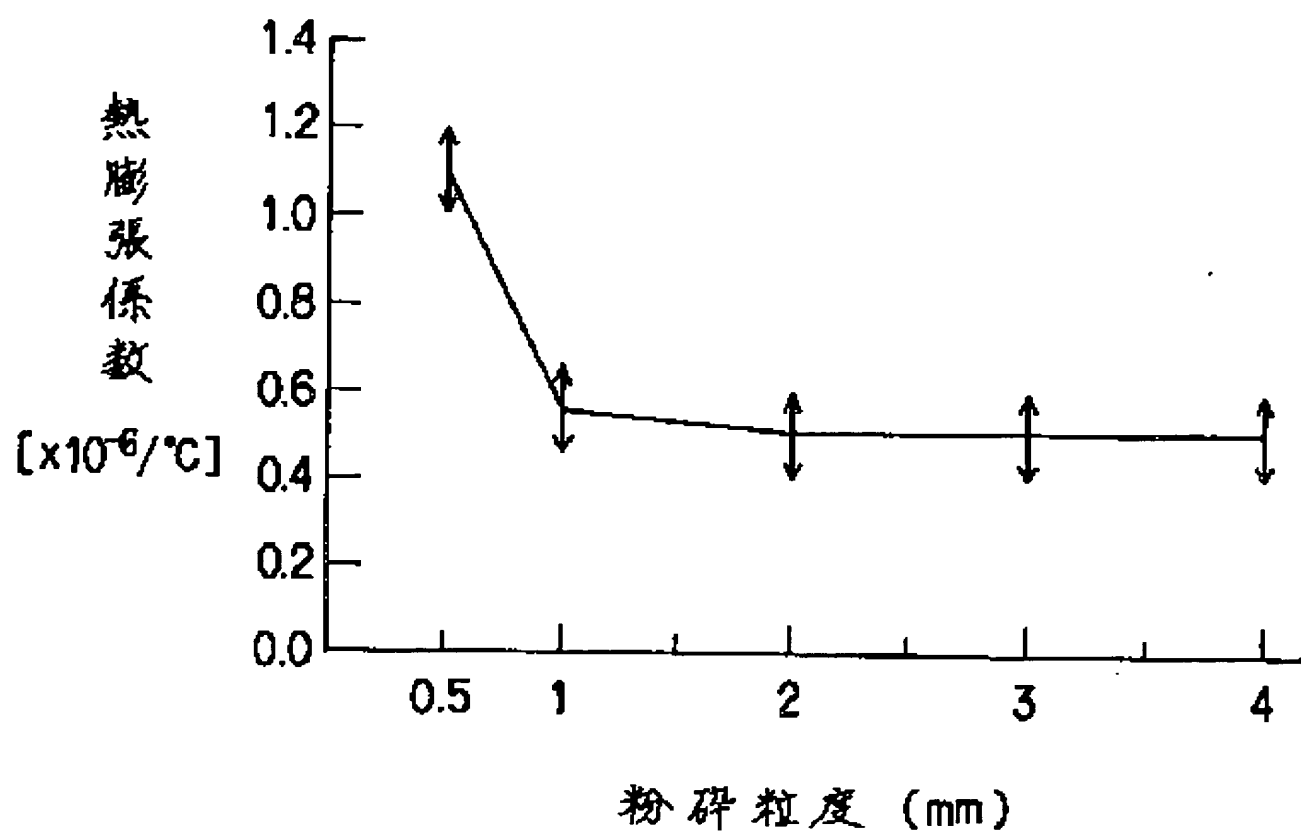
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[Brief Description of the Drawings]

[Drawing 1] The characteristic ray Fig. of the coefficient of thermal expansion of the cordierite ceramic object over the grinding grain size of a grinding object of the example 2 of an operation gestalt.

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[Translation done.]



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